

REMARKS

This Response is submitted in reply to the final Office Action dated October 3, 2006, issued in connection with the above-identified application. Claims 1-13 are pending in the application. In the Office Action, Claims 1-13 are rejected under 35 U.S.C. §102. In response, Claims 1, 2, 6 and 7 are amended herein. No new matter has been entered by way of the amendments. In view of the amendments and/or at least for the reasons detailed below, Applicants believe that the rejections are improper and, thus, respectfully request favorable reconsideration.

The Office Action rejects claims 1-13 under 35 U.S.C. §102(b) in view of U.S. Patent No. 6,432,579 to Tsuji et al. ("*Tsuji*"). Applicants respectfully disagree with and traverse this rejection for the following reasons. *Tsuji* generally provides an anode having a base (i.e., a current collector) and a sintered material as an anode-active material. (See, *Tsuji*, col. 2, lines 29-33). The anode-active material is sintered to the current collector. The Office Action contends that this single anode-active material layer constitutes two layers. In particular, "the examiner strenuously contends that the part of the sintered material which is integrated with the base material (the current collector) represents that anode active material layer provided on the anode current collector which is alloyed therewith; and the part of the sintered material which is not integrated with the base material) the current collector represents the layer including silicon oxide provided over the anode active material layer." (See, Office Action, pg. 5). Applicants respectfully disagree.

Amended independent claims 1 and 6 of the present application recite, in relevant part, a first layer including anode active material which is provided on the anode collector, and which is alloyed with the anode collector on at least a portion of interface between the anode active material layer and the anode collector, wherein the anode active material includes at least one type of compounds of silicon; and a second layer including silicon oxide having a thickness of about 50 nm to about 300 nm wherein the layer is provided on the anode active material layer. Amended independent claims 2 and 7, recite, in relevant part, a first layer including anode active material which is formed on the anode collector by at least one method selected from the group consisting of a vapor-phase method, a liquid phase method, and a sinter method, wherein the anode active material includes at least one type of compounds of silicon; and a second layer

including silicon oxide having a thickness of about 50 nm to about 300 nm wherein the layer is provided on the anode active material layer. The amendment to independent claims 1, 2, 6 and 7 are supported in the specification. (See, specification, page 6, lines 22-30 and page 11, Table 1).

In contrast to Applicants' independent claims, *Tsuji* fails to disclose or suggest a first layer including anode active material formed or provided on the anode collector and a second layer including silicon oxide formed or provided on the first layer. Rather, *Tsuji* discloses a single sintered coated film integrated with a current collector. (See, *Tsuji*, column 2, lines 33-54). Though the Office Action contends that this single sintered coated film represents both the first and second layers of the present invention, *Tsuji* discloses only sintering a single silicon-containing coated film and a base material. The presence of a single layer is even more evident when considering the objectives in *Tsuji*, in contrast to those of the present invention.

For example, there has been a problem with anode applications, where when the anode active material layer is formed on the anode collector by the vapor-phase method, liquid phase method, or sinter method reacts to an electrolyte, rise of internal resistance and lowering of capacity of the battery, after being held at high temperatures. (See, specification, pg. 2, lines 9-13). In this regard, the layer including silicon oxide 22C is intended to inhibit reaction between the anode active material layer 22B and an electrolyte solution described later at high temperatures, and to prevent rise of internal resistance and lowering of capacity of the battery. (See, specification, pg. 7, lines 4-8). *Tsuji*, by contrast, states that the sintered material is preferably a porous material having a porosity of 15 to 60% so that the electrolyte is sufficiently made contact with the active material. (See, *Tsuji*, column 4, lines 64-67). This sufficient contact between the electrolyte and active material is precisely what the present invention seeks to avoid by inclusion of the second layer.

Applicants respectfully submit that the single layer disclosed in *Tsuji* can not be considered to be multiple layers due to a purported diffusion or integration or sintering of the anode-active material into the current collector. Given that *Tsuji* does not disclose a first layer and a second layer as recited in amended independent claims 1, 2, 6 and 7, Applicants further submit that *Tsuji*, having only a single sintered anode active layer, would exhibit similar problems such as reaction with an electrolyte solution, as described above.

Furthermore, *Tsuji* fails to disclose any layer containing silicon oxide. Therefore, Applicants respectfully submit that the Office Action contention representing *Tsuji* as containing a first and second layer is still inaccurate based on the disclosure in the cited reference. For example, *Tsuji* initially discloses that silicon oxide can be used. However, *Tsuji* further explains that silicon oxide, or any silicon compound would still have to be converted into silicon by decomposing or reducing in a non-oxidizing atmosphere. (See, *Tsuji*, column 3, lines 53-62). *Tsuji* reinforces this by further stating that the “elemental substance of silicon” is particularly preferred, with a preferable purity of 90% by weight or more. (See, *Tsuji*, column 3, lines 62-67). This preference likely exists to prevent an additional processing step of converting a silicon compound to silicon, as is evident by the fact that all examples disclosed use commercially available crystalline silicon powder having a purity of 99.9%. (See, *Tsuji*, Examples 1-8 and Comparative Examples 1-4). Consequently, regardless of the initial form of silicon, *Tsuji* fails to disclose a finished anode with a layer containing silicon oxide.

Accordingly, since *Tsuji* does not recite all elements of independent claims 1, 2, 6 and 7, Applicants respectfully request that the 35 U.S.C. §102 rejections of claims 1-13 be withdrawn.

The Office Action rejected claims 1-13 under 35 U.S.C. §102(e) in view of U.S. Patent Application Publication No. 2002/0054249 to Yamamoto et al. (“*Yamamoto*”). Applicants respectfully disagree with and traverse this rejection for the following reasons. *Yamamoto* fails to disclose or suggest a first layer including an anode active material which contains at least one type of compounds of silicon and a second layer including silicon dioxide, as required, in part by independent claims 1, 2, 6 and 7. In contrast, *Yamamoto* discloses any combination of a first carbon layer and a second lithium-occluding material. (See for example, *Yamamoto*, page 2, [0022], page 4, [0066], page 6, [0086], page 7, [0099], page 9, [0125], and page 10, [0138-139]). Though the second lithium-occluding material can contain silicon oxide, as shown on page 4, paragraphs 61 and 62, the first carbon layer lacks compounds of silicon, as required by the claims. Moreover, *Yamamoto* teaches away from silicon-containing anode active material layers by stating that elements, such as silicon, in the anode active material inevitably leads to localization of an electric field and corresponding difficulty in maintaining higher levels of cycle properties. (See, *Yamamoto*, page 1, [0013]). Further, *Yamamoto* states that an anode obtains

lower operating voltage and capacity when mixing metal (e.g. silicon) with carbon material versus anodes of carbon material alone. (See, *Yamamoto*, page 1, [0014]).

With regard to independent claims 1 and 6, *Yamamoto* fails to disclose or suggest an anode active material layer which is provided on the anode collector, and which is alloyed with the anode collector on at least a portion of the interface between the anode active material and the anode collector. Rather, *Yamamoto* provides a carbon anode 2d made out of graphite (and not including Si or compounds thereof) that is formed on the anode collector 1d. (See, *Yamamoto*, Figs. 14 & 15, and [0130]). Even assuming that the carbon anode 2d is an anode active material, *Yamamoto* certainly does not disclose that this layer 2d is alloyed with the anode collector 1d, as recited in independent claims 1 and 6.

With regard to independent claims 2 and 7, *Yamamoto* provides that the carbon anode is formed into a paste, applied to the current collector, and then dried. (See, *Yamamoto*, page 4, [0067]). Therefore, *Yamamoto* fails to disclose or suggest an anode active material formed on the anode collector by at least one method selected from the group consisting of a vapor-phase method, a liquid phase method, or a sinter method, as recited in claims 2 and 7. Moreover, Applicants respectfully submit that the claimed invention formed by one of the above mentioned methods is structurally different and has improved performance characteristics over the paste dried anode taught in *Yamamoto*. (See, specification, page 11, Table 1). Specifically, the paste method, as compared to those formation processes in independent claims 2 and 7, showed no difference in maintenance ratio of discharge capacity after hot holding regardless of the use of a silicon oxide second layer. (See, specification, page 13, lines 20-30). Moreover, the maintenance ratios were lower than those examples implementing one the methods listed in the claims. (See, specification, page 11, Table 1).


Accordingly, Applicants respectfully request that the 35 U.S.C. §102 rejections in view of *Yamamoto* with regard to claims 1-13 be withdrawn.

For the foregoing reasons, Applicants respectfully submit that the present application is in condition for allowance and earnestly solicit reconsideration of same.

Respectfully submitted,

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